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FIRE-TELEGRAPHS.

The admirable paper "On Fire-Telegraphs," by Mr. R. von Fischer Treuenfeld, which was read before the Society of Telegraph Engineers at their meeting on the 28th ult., has brought prominently forward a subject which has been mooted from time to time of recent years, but which has never until now received in England the attention that it merits. It would appear at first sight surprising that in London at least, where so much attention has been given to the protection of life and property against fire, little more than a passing notice has hitherto been bestowed upon Fire-Telegraphs. A question is now and then asked in "the house;" we occasionally read the notice of some motion about to be put—nay, we ever hear of the appointment of a Committee to inquire into the subject. The labours of the Committee are no doubt arduous, much information is gleaned and carefully sifted, the inevitable report is probably submitted, and the question is then shelved again until a more convenient season.

No practical proverb is more frequently verified than this, that "what is everybody's duty becomes nobody's duty." The energetic chief of the London Fire-Brigade would probably say, and say rightly, too, that "Fire-Telegraphs" are no concern of his. His stations are all in telegraphic communication with each other; he can at the shortest possible notice summon his men from east, west, north, or south; his duty begins the moment that an alarm of fire is communicated to him, and ceases with the extinction of that fire. He has to face the fact that there is a fire in existence, and that it must be put out; it is the duty of those whose interests are more immediately at stake to see that speedy intimation is forwarded to him. The Insurance Companies, again, who it might be imagined would be alive to the value of a Fire-Telegraph system in the metropolis and the other large towns of England, appear to close their eyes to the fact, and turn a deaf ear to the spasmodic appeals which from time to time are made to them. Some would go even so far as to allege that they would exhibit something more than a passive opposition to Fire-Telegraphs were an effort made to introduce them; the Companies, we are told, would not look altogether with favour upon any scheme which would minimise the chances of a serious fire occurring. They would argue that were this done, people would be slow to pay any insurance premium for protection against a remote contingency, and that in the long run it is better to incur the risk of heavy claims for damage done rather than that of a reduced income.

Then the British public is appealed to. That long-suffering, conservative body is proverbially slow to move. So many new-fangled notions are almost daily being brought before them: so many fair hopes have been built upon Electricity—whose practical applications they are constantly being told are as yet in their infancy—all of which, however, have either proved abortive or turned out to be "white elephants," that it almost ceases to be a subject of wonder that they are callous and apathetic to Fire-Telegraphs, the latest application of Electricity submitted to their notice. We have, however, to remind them that the question of Fire-Telegraphs has now been removed from the region of experiment into that of practical success. The Americans, with the go-ahead tendency characteristic of the race, have tried and adopted Fire-Telegraphs; on the Continent of Europe they are spreading fast, and in no single instance where the system has been introduced has an idea been entertained for a moment of allowing it to be abandoned.

The object of a system of Fire-Telegraphs is to give the speediest possible intimation of the outbreak of fire. It is needless to discuss at any length the value which attaches to this. A fire having originated, it becomes a matter of vital importance that every one from whom assistance can be obtained should be at once informed of the fact. Then, if on any occasion, will it be found that "a stitch in time saves nine." A few bucketfuls of water applied at the outset will extinguish a fire, against which half-a-dozen engines may, in the course of a few minutes, long play powerless. It is, of course, impossible to lay down any hard-and-fast rule by which the chances of a fire becoming "serious" may be calculated: the factors which have to be taken into account, such as the water supply, the nature of the combustible materials, the prevalence of a wind, &c., are too variable to admit of a law being laid down. Mr. Treuenfeld says that "in general the chances of a fire becoming 'serious' increase at least with the square of the time which elapses between the outbreak of the fire and the arrival of the fire-brigade." We are inclined to go even farther than this in the generality of cases. Catch a fire ten minutes after it has shown itself: it will, we imagine, be nine times easier held and beaten down than after it has been raging half-an-hour.

Granting, then, the necessity which exists for

instant communication being made to the Fire Brigade of the outbreak of a fire, there can be no two opinions as to the best means of effecting this. So far as we are aware, only two methods have hitherto been adopted for attaining the end in view—the one, if it can be called a method, which is universal in England—trusting to blind chance—the other, which is in general use in America and on the Continent—relying on a well-organized system of telegraphs. From the very carefully-compiled statistical tables interspersed through Mr. Treuenfeld's paper, we have gathered the following, which shows the ratio existing between *points* from which electrical alarm signals can be given, and the population in the principal cities of America, Germany, and England. The first line gives the proportion in the best-served, and the second that in the worst-served town of each country.

In American Towns	1 point to every 780 inhabitants. 1 point to every 2093 inhabitants.
In German Towns..	1 point to every 990 inhabitants. 1 point to every 9898 inhabitants.
In English Towns...	1 point to every 15600 inhabitants. 1 point to every 79215 inhabitants.

Further statistics of a no less interesting and equally instructive nature are placed before us by Mr. Treuenfeld; in fact, his Tables form of themselves most pleasant reading. The results to which they all point may briefly be summed up as follows:—

Average percentage of serious fires in towns *without* Fire-Telegraphs	29
Average percentage of serious fires in towns with *imperfect* Fire-Telegraphs	17
Average percentage of serious fires in towns with *Automatic Fire-Telegraph Annunciators*, combining Morse-speaking stations	4
Average percentage of total destructions in towns *without* Fire-Telegraphs	13
Fire-Telegraphs *reduce total destructions*—per cent.	50
Fire-Telegraphs *reduce serious fires*—per cent..	55

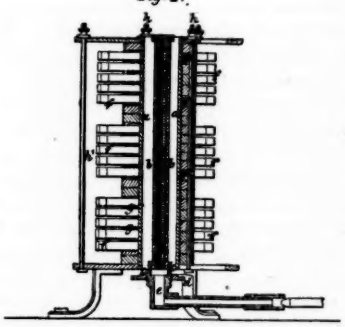
There is no gainsaying facts, and recognising the truth of these conclusions, which cannot be set aside, it would really seem to be little short of culpable negligence if active steps were not taken by the English people to protect themselves against an enemy which is ever hovering around them, and ready to show front on the slightest provocation.

Various systems are being ventilated at the present moment, which we must content ourselves with simply naming. There is the system which has already done such excellent work on the Continent, and which was exhibited by Mr. Treuenfeld during the reading of his paper. There is the American system—perhaps in no way inferior to that already named—which forms part of the stock-in-trade of the Exchange Telegraph Company; and there is yet another claimant for public favour in the Autokinetic Telegraph, to which allusion has oftener than once been made in these columns. We propose to describe each of these at length, and show what seem to us to be the special features of each.

WRAY'S THERMO-ELECTRIC PILE.

THE new form of thermo-electric pile patented by Messrs. C. and L. Wray, Jun., was brought before the Society of Telegraph Engineers at their opening meeting during the current session. A *resumé* of the advantages claimed for it over the better-known form introduced by Mons. Clamond has already appeared in the columns of the JOURNAL*. We now subjoin the drawings of the elements as well as a section of the pile complete, (fig. 1,) showing how the various parts are built

Fig. 1.



together. Before, however, entering into a short description of this, it may be well to look for a moment at the construction of the bars themselves. Figures 2 and 3 will serve to show how the bars are formed, representing as they do horizontal-

Fig. 2.

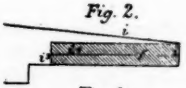
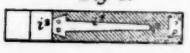


Fig 3.



vertical and longitudinal-horizontal sections. *f f* are the negatives which are formed of an

* TELEGRAPHIC JOURNAL, Vol. iv., page 307.

alloy consisting of two parts of antimony and one of zinc; *i i* indicate the positive metal—sheet-iron—at the heated end. i^2 is the outer part at the cool end; while i^1 shows the elongation or tongue which forms so distinct a feature in the casting of the bars. The effect of it is to raise very materially the breaking strain, and so get rid of the liability to fracture, to lower the internal resistance, and strange to say increase the electro-motive force.

Returning to figure 1, a vertical section is shown of a pile of 225 couples, built in three sections of 75 couples each. *a* is the heating chamber, formed of an earthenware cylinder, against which the couples abut; this can very speedily be raised to a red heat, and so distributes the caloric uniformly, while it at the same time effectually protects the ends of the bars from fusion or oxidation. *b* is a Bunsen or other suitable burner, inside which is a cylinder of wire gauze similar to that employed in the safety-lamp. This prevents explosions when the light is applied, and at the same time by causing a more equable distribution of the gas tends to render the heating of the bars uniform—a point, it is needless to again urge here, of vital importance in any practical form of thermo-battery. It is to attain the same end that the disc *d* is placed at the lower end of the chamber. This disc screws up and down the pipe *e*, and thus regulates with much nicety the admission of air for combustion through the openings *c c*. The draught is further controlled by a perforated earthenware cover on the top of the cylinder. *f f f* represent the thermo-electric couples, which are supported upon the insulating annular discs, *g g g*. These discs are again supported on blocks, which thus carry the weight of the several layers of bars. Through these blocks run the binding rods *h h*, which serve to give additional stability to the entire structure.

We forbear entering into a comparison of this with the other forms of thermo-piles previously in existence, for any attempt at comparison would speedily cease to be such, and would merely resolve itself into an enumeration of the advantages which Messrs. Wray's form undoubtedly possesses over every other. We are not aware whether it has yet been brought into practical use; if not, it certainly ought to be without further delay, for, looked at theoretically, it is difficult to see what further improvements can be effected in it.

An admirable portrait of Sir William Fothergill Cooke, the only surviving member of the illustrious trio who fairly earned the title of "Pioneers of Telegraphy," has just been presented to the Society of Telegraph Engineers by Mr. Latimer Clark. The artist is Miss Thomas, whose striking likenesses of Dr. Siemens, Mr. Latimer Clark, and the late President, Mr. C. V. Walker, F.R.S., formed so prominent a feature at the recent Conversazione of the Society.

ON THE PASSAGE OF STRONG INDUCTION CURRENTS THROUGH LIQUIDS.

THE laws according to which powerful induction currents are conducted through liquids have lately been investigated by M. Hermann Herwig *(Poggendorff's Annalen)*. He used a common glass trough, into which was introduced, as conducting liquid, commercial alcohol, or a mixture of alcohol and water, alcohol and ether, or alcohol and oil of turpentine, or very dilute sulphate of zinc solution, while the electrodes were plates of polished platinum, platinised platinum, or amalgamated zinc. The electrodes were taken of large section so as to exclude spark discharges. The wires of the primary circuit went through a mercury commutator, a tangent galvanometer, and a Siemens resistance-scale, to the inductor. The wires of the induction coil went from the trough to a very sensitive mirror galvanometer, the deflections of which were observed with a telescope each time at closing or opening of the primary circuit, and the resistance of the liquid deduced.

In order to determine this resistance, a number of parallel experiments were made, in which, instead of the liquid, wire coils of different resistances were inserted in the path of the induction current, till the deflection of the galvanometer was the same as when the liquid was in the circuit. The resistance of the wire coil was then the same as that which the liquid offered to the current. From all these experiments it first appeared, that for a determinate electro-motive force the insertion of additional wire resistances weakens the galvanometer action in precisely the same manner; consequently, for such strong currents as were employed, Ohm's law has full validity. Further, as to different electro-motive forces of induction, it was found that these increase more quickly than the primary strengths of current, which might be expected, since the function of magnetisation of the iron bundle of the inductor increases.

The measurements of resistance of the above mentioned liquids are shown in five large tables, from which the following conclusion is drawn:—The specific resistance of the liquids to strong induction currents becomes less, in comparison with the wire-resistances, (1) when the electro-motive force of the induction is increased; (2) when the cross-section of the liquid is decreased; (3) when the length of the liquid layer is increased.

Taken together, these three exclude the possibility of the phenomena being explained by an ordinary polarisation of the electrodes. Such polarisation would, indeed, produce a less resistance with increased length of the liquid, but the influence of increased electro-motive force and decreased section must act in quite the opposite direction. Experiments, however, made by M. Herwig on polarisation showed that it plays here a different *rôle* to that in the galvanic current.

When the induction currents were sent by polished platinum electrodes through sulphate of zinc solution, the action of polarisation, especially when not the opening and closing current alter-

nately, but only one kind of current was sent through the liquid repeatedly, appeared very distinctly in a marked weakening of the current. This polarisation was, with exactly the same dimensions of the interposed liquid, and with nearly equal strengths of current, greater with the small inductor than with the large one. Now, since, in the former, the internal resistance was greater than in the latter, it is clear, that with it the same electricity traverses the circuit much more rapidly than with the large inductor. Hence M. Herwig infers, that the rapidity with which a given quantity of electricity flows through a polarisable liquid apparatus in a strong induction current, increases greatly the amount of polarisation.

The experiments further proved, that in the case of the large inductor, notwithstanding considerably greater electro-motive force, the specific liquid resistance was nearly double as much as with the small inductor, when cross-section and length of liquid column were in both cases the same. Thus the quicker equalisation of the small inductor caused, besides greater polarisation, an easier passage of the current.

"If now, it were sought," says M. Herwig, "to reduce all the observed phenomena to the action of polarisation, we must suppose regarding it that coating the electrodes with gas in the cases described, does not hinder the passage of the current, but facilitates it. Therewith would also the above-mentioned favourable influence of an increasing electro-motive force and a decreasing electrode be explained; with the smaller surface of electrode the polarisation is greater indeed also in galvanic currents. It must, however, be maintained, that polarisation still preserves its character of an opposing force, as appears from the above experiments in which a weakening occurred. Hence we should have a double action of polarisation that is difficult to conceive, and quite special conceptions must in any case be formed as to the *rôle* of the quantities of the gases involved. It is thus sufficiently evident, that quite different ideas from those ordinarily associated with polarisation must be adduced in explanation."

The coating of the electrode plates with gas is, moreover, not at all necessary for the occurrence of these phenomena. Experiments with sulphate of zinc solution between platinised platinum electrodes, or between electrodes of amalgamated zinc, and with alcohol, in which no weakening of the current by polarisation was perceptible, still showed all the phenomena with regard to specific resistance, and the influence of the more rapid course of the induction current (though not in the same degree), as in the experiments with demonstrable polarisation.

An interesting fact may here be noted, which first appeared with a mixture of water and alcohol. "A few drops of alcohol added to the water having a resistance of 2,194 millions (the resistance of mercury being taken as unity), bring down the resistance to 1,900. And in the case of mixtures of water and alcohol in equal volumes, resistances were had, which but little exceeded that of water alone, though alcohol alone under the same circumstances shows twice the resistance. Further light on this was afforded by mixtures of alcohol with ether, and alcohol with oil of turpentine. Both the substances, ether and oil of turpentine, have separately an extremely great resistance. When added, however, in certain proportions, to alcohol, they may even diminish its resistance. The fact can best be followed in the alcohol turpentine mixtures; and here it appears, that little alcohol, mixed with much oil of turpentine, hardly conducts better than oil of turpentine alone; that with increasing proportion of alcohol, the relation becomes quickly more favourable, and soon a mixture is produced, still containing abundant oil of turpentine, which has no greater resistance than alcohol alone; and that lastly, with a greatly preponderating quantity of alcohol, the admixture of a little oil of turpentine furnishes a less resistance than that of pure alcohol. The analogies which this behaviour of very bad conductors finds in the case of good conducting liquids and mercury alloys are known."

M. Herwig now proceeds to a fuller explanation of the influences which according to the above experiments are exerted by the electro-motive force of induction, the cross-section and length of the liquid layer, and the quick passage of the induction current, on the specific liquid resistance. "All these influences are generally operative, even with as much avoidance of polarisation as possible; but they are considerably increased when certain quantities of gas are produced on the electrodes. We may, from all these phenomena, draw the probable conclusion, that the equalisation of the moved electricities is delayed at entrance into the liquid, and then at length, with the corresponding potential, occurs for the most part by a kind of discharge. The retardation is intimately connected with the gases of polarisation always present, and, with a certain small quantum of these, its influence may considerably predominate over the opposing force of polarisation. The liquid enclosed between the metal electrodes will thus have the greatest similarity to a condenser, between whose coatings equalisations occur through the insulating layer."

In support of this view, M. Herwig adopted two methods of experiment. First, with special arrangements he broke the induction circuit shortly after closing of the primary circuit, and found, at moments suitably chosen, a considerably greater action in the galvanometer as compared with the ordinary mode of procedure, where the induction circuit always remains closed. "This shows," says the author, "that the electricities that have flowed to the liquid are there retained, and partly equalised backwards again through the induction current, if the conducting circuit remains closed. If the induction current be interrupted at the proper time, this opposite flow is rendered wholly or partly impossible, and the action in the original direction of flow appears in much greater strength. We have here, then, in part, a similar process to that with an open induction spiral; and to form a complete conception of the phenomena, we may here also have recourse to the oscillations known to occur in open induction spirals, as observed by MM. Helmholtz, Blaserna, and Bernstein. In some connection herewith, at least, is the observation of M.

Bernstein in other experiments, that in liquids, after cessation of a current passing through them, oscillations also occurred. I would further call to mind, that when bifilar wire-coils were inserted instead of the liquids, nothing similar was observable."

The second method consisted in offering two paths of equal resistance to the induction current; the one contained the liquid column, the other corresponding wire-coils, so that each had the same effect on the galvanometer. If now these lines circle round the magnet in opposite directions, it is observed that the electricities only in the first moment choose the liquid path for equalisation; and immediately thereafter are mostly equalised on the wire-path. These experiments with the differential galvanometer were carried out to a large extent with a great variety of conditions, and the same result was obtained with alcohol and with sulphate of zinc solutions both between polished platinum electrodes and those of platinised platinum; but hardly with sulphate of zinc solution between amalgamated zinc plates. When in the experiments a second wire-coil was inserted in place of the liquid nothing of the kind was perceived.

"The discharge character," concludes M. Herwig, "of the passage of induction currents through liquids, is rendered very probable by the foregoing."

Notes.

DR. C. W. Siemens, F.R.S., has invited the students of the institution of Civil Engineers to visit his telegraph factory at Old Charlton, on Saturday, April 7th. The various processes connected with the manufacture of submarine cables and telegraph apparatus will on that occasion be explained and illustrated to them.

Mr. Donald Currie read a paper at the Royal United Service Institution, on the 2nd inst., upon the subject of "Maritime Warfare." Foremost amongst the points of special importance which he urged was the necessity for having good telegraphic communication; and he argued at considerable length in favour of an alternative route being established *viâ* the Cape of Good Hope to the Eastern Colonies and Australia. In the discussion which followed, the advantages which would be derived from direct telegraphic communication between England and the Cape were enlarged upon.

In the system of underground work which is now being laid for the German Government between Berlin and Halle, by Messrs. Felten and Guilleaume, of Cologne, the insulating covering of the wires consists of two layers of Chatterton's compound and two layers of gutta percha, placed alternately—the conductor being covered first with Chatterton's compound. A full description of this work will shortly appear in the columns of the JOURNAL.

A very important paper has lately been read before the Society of Arts by Mr. Barff, Professor of Chymistry to the Royal Academy, upon a method of preserving iron from rust by coating it with its own magnetic oxide. The facts which Professor Barff has brought forward, and the specimens which he has exhibited, are such as to justify the belief that his discovery will prove to be of enormous value, and that it will, indeed, render all kinds of ironwork, however much exposed to weather or to corrosive vapours or liquids, practically indestructible and everlasting.

Mr. W. H. Preece and Mr. H. G. Fischer, the Commissioners recently appointed by the English Government to inquire into the working of the telegraphs in the United States, will take their departure for America about the middle of next month.

Mr. Graham Bell, the inventor of what Sir William Thomson named "the wonder of wonders" of telegraphic science, is making active progress with his Telephone, and accounts reach us from time to time of the advances which are being made in the construction of the apparatus. Mr. Bell delivered a lecture on the subject at Salem, Mass., on the evening of the 12th ult., and on the following morning one of the newspapers published in Boston, eighteen miles away, gave an account of the lecture, which had been received by telephone from the lecture-room. Not only was the voice of the reporter clearly recognised at Boston, but the receivers of the message are stated to have heard distinctly the applause of the audience. The Morse Alphabet, composed of musical sounds, the song of "Auld Lang Syne" as well as a short speech were all transmitted *sotto voce* from the platform, and made distinctly audible throughout the entire room. On the evening of the 23rd ult. more extended experiments were tried. Mr. Bell was again on the platform at Salem, whilst his assistant, Mr. Watson, took up his position at Boston. A tune on the organ, as well as one on the cornet, were played at Boston, and distinctly heard by the audience at Salem, but for some reason or other the results obtained at the Boston end were not so satisfactory as on a previous occasion. "The use of the line," we are told, "for business purposes, interfered sadly with those of the experimental operations, the click of an instrument somewhere along the line being distinctly audible anywhere in the room

most of the time. After a time Mr. Watson found that this annoyance might be obviated, by pressing a membrane which acted like a telegraph-key in shutting off unwelcome telegraphic communications. The sounds made and the words uttered then became tolerably distinct."

A paper by Mr. Willoughby Smith, "On Underground Telegraphs," is to be read before the Society of Telegraph Engineers at their next meeting, on Wednesday, the 28th inst. There is probably no one living whose experience upon the subject extends over so wide a range as that of Mr. Willoughby Smith; and as he is said to have been recently engaged upon experiments as to the best mode of protecting the gutta-percha covering of underground wires—the results of which will no doubt be embodied in this paper—a most valuable communication may be looked for.

Mr. Charles H. P. Patey, formerly Principal Clerk for Telegraph work in the Secretary's Office, has recently been appointed an Assistant-Secretary to the Post-Office.

The Philosophical Society of Glasgow, under the Presidency of Sir William Thomson, have prepared a petition to the House of Commons, regarding the Attorney-General's Patent Bill. Under the existing arrangements a sum of £25 is paid by the applicant for a Patent, on the application and sealing of the patent: a further sum of £50 has to be paid at the end of the third year, and £100 at the end of the seventh, thus making in all £175. In lieu of this the New Bill, while reducing the first payment of the stamp duties from £25 to £12 10s., proposes to exact in addition to the present payments a fourth payment of £100 at the end of the twelfth year, thus increasing the total charges for a Patent from £175 to £262 10s. Sir William Thomson, and with him the Philosophical Society of Glasgow, make a vigorous protest against this, as well as several of the other *provisos* of the Bill, including the duration of a Patent, which they argue should be extended to a period of not less than twenty-one years; and they call upon the various societies and corporate bodies to co-operate with them in gaining the objects which they have in view.

Tree-felling by electricity is, we are inclined to think, "the latest thing out," in the way of the practical applications of the science. We read that Mr. H. H. S. Parkinson and Mr. W. H. Martin have patented a process by the application of which a tree, that at present takes two hours to fell, will come to the ground in fifteen minutes. The plan is simple enough. The copper wires proceeding from the electrodes of a powerful galvanic battery are connected with a piece of platinum, which of course becomes instantly red-hot. In this condition, it is see-sawed across the trunk of the tree which is to be felled. There is no waste of wood, no sawdust, and the idea which certainly seems pretty enough on paper, is said to have been successfully realised.

The Indo-European Company notify the interruption of the Singapore-Batavia Cable, necessitating the forwarding by steamer from Singapore to Batavia of all telegrams intended for Java, Australia, and New Zealand. They at the same time announced the restoration of the Saigon-Hongkong Cable, and with it the re-establishment by their line of direct communication with China and Japan.

The report of the India-rubber, Gutta-percha, and Telegraph Works for the year 1876 states a net profit of £30,764 was made, which has more than sufficed to clear off the debit balance of £24,183 in 1875. The balance of £8,905 is carried forward.

TRAFFIC RECEIPTS.

The traffic receipts of the Direct United States Cable Company for the week ending February 17th amounted to £4,000; for that ending February 24th, £3,770; for that closing on the 3rd of March, £2,800; and on the 10th March, £1,850. The shilling tariff accounts for the decrease in the two weeks last quoted. The perfect condition of the Company's cable and the efficiency with which it is worked admitted of the entire traffic being disposed of with little or no delay.

The traffic receipts of the Western and Brazilian Company, for month of February, amounted to £11,026, as against £11,343 for the corresponding period of last year.

The traffic receipts for the Great Northern Telegraph Company, for the month of February this year amounted to 320,000 francs, as against 303,180 for the same month last year.

Those of the Direct Spanish Company, for the same month, were £784 18s. 4d., against £679 7s. 9d. in the corresponding period of last year.

The traffic receipts of the newly formed West Coast of America Company, for the four weeks ending 16th December, 1876, were £2,839; for the four weeks ending 13th January, 1877, £2,533.

During the month of February, 2,455 messages, estimated to produce £2,300, passed over the lines of the Cuba Submarine Company. During the same month of last year, the number was 2,642, producing £2,525. The traffic receipts for the month of December, estimated at £2,500, realised £2,475.

City Notes.

Old Broad-street, 14th March, 1877.

THE fight between the Direct United States Cable Company on the one side and the Anglo-American Telegraph Company and the Globe Company on the other side, is still undecided.

It must be acknowledged that the Anglo-American Company, which has no doubt a great interest in seeing its younger rival weakened, has throughout this controversy observed a strict adherence to the principles of what may be called fair fighting. They have done no more than lower their rates, a very legitimate expedient, if a too successful competitor becomes troublesome; and apart from a little joking in the circular in which their decision was announced, everything has on their part been done in as dull and as respectable a fashion as it behoves an old-established Company, with a character to lose. The same praise, however, can hardly be extended to the Globe Company.

That noble dividend-equalising institution began by associating itself with a clique of financiers and stock-jobbers. Far be it from us to disparage in any way the amusing and lucrative profession of a financier or a stock-jobber; but we have always held that it was more befitting a chairman of a large public Company to restrict himself to calling in the services of such gentlemen when his Company wanted them as an employer, in preference to associating himself with them as a "pal." However, tastes differ, and Mr. Pender evidently preferred the line he took.

At the last adjournment of the Direct Company's meeting Mr. Pender had his Committee appointed. It consists of gentlemen of his colour. A proposal from a shareholder, who took the audacious liberty of disagreeing with Mr. Pender, and who proposed to appoint a united Committee—*i.e.*, half Penderites and half shareholders of a different opinion—was not acceded to by Mr. Pender. In the heat of the debate, Mr. Pender, reclining gracefully on his majority, intimated to the Directors that in the House of Commons a ministry which failed to obtain a majority, took the hint and withdrew from office.

Surely for one moment this sagacious "British Merchant" must have forgotten what he was talking about. No doubt a ministry beaten by a majority goes out of office but—has even Mr. Pender ever known the leader of Her Majesty's Opposition to go round amongst honourable members trying to create faggot votes, and putting legislators' voting powers into the names of nominees pledged to support his policy? It affords a peculiar insight into the manner in which Mr. Pender has understood the working of the largest legislative assembly of the world, of which he is a member, when he compares votes of the members of the House of Commons to the votes of junior clerks and other nominees of shareholders in a Joint Stock Company. When Mr. Pender will be leader of Her Majesty's Opposition, he will find out that in that assembly votes of censure on the ministry cannot be syndicated.

We certainly trust in the interests of telegraphy that the Directors of the Direct Company will have a keener sense of honour than to abandon their Company because a temporary vote has gone against them. The process by which Mr Pender has obtained his majority is, it seems, legal in this country, but is it for all that honourable? In Belgium a heavy fine would have been the result, in France probably inprisonment. We refer our readers to the *Daily News* of the 12th instant. That well-informed and enterprising journal points out in its money article how these fine manipulations, which are criminal on the Continent, are unfortunately still allowed in this country, and calls upon enterprising Members of Parliament to try to have the obvious defect remedied. Would not Mr. Pender like to take this matter up?

But again, we say to the Directors of the Direct United States Company, as we have so often said before, Stick to your colours. When your Company was in low water, had no receipts to speak of, had a heavy debt, and at last was ridiculed by everybody, did Mr. Pender then come forward to help your shareholders? Not he. Now that by hard work and good and disinterested management your Company has turned the corner, and is getting prosperous, he comes in to "save" you, and would, no doubt, like to take the presidential chair, and cry to the admiring shareholders, Behold, I have come, and now everything goes well.

This trick has been often enough played by one of our most successful railway men, but Heaven forbid that we should see it introduced into Telegraphy!

Proceedings of Societies.

THE ROYAL SOCIETY.

"*On Magneto-Electric Induction in Liquids and Gases.—Part I. Production of Induced Currents in Electrolytes.*" By J. A. FLEMING, B.Sc. (Lond.). Received February 6, 1877.

(ABSTRACT.)

THIS paper contains an account of an experimental inquiry into the production of induced currents in liquids by magneto-electric induction. Faraday examined one such case of induction, in which a conducting liquid was used as a secondary circuit. He coiled round the armature of an electro-magnet an india-rubber tube filled with dilute sulphuric acid, and found on making and breaking the primary circuit, the induced currents generated in it, as in the case of metallic conductors. But he could not obtain any effect when brine, sulphuric acid, or other solutions were rotated in basins over a magnet, or enclosed in tubes and passed between the poles. He failed also to detect any magneto-electric current in water flowing across the earth's lines of magnetic force (viz., in the river Thames).

Since the reason for these negative results is not at once obvious, it seemed desirable to repeat and extend them to other cases, so that, if possible, the analogy of electrolytic with solid conductors might, in respect to magneto-electric induction, be completed. In addition, the subject involves the interesting question of the magneto-electric phenomena accompanying the flow of ocean-currents and other large masses of water.

Three cases of induction in liquids flowing in a magnetic field or traversed by lines of magnetic force have been examined.

1. *Production of induced current in a liquid stream*

flowing uniformly in a constant magnetic field.—When a stream of conducting fluid flows vertically down between the poles of a magnet, a tranverse current is produced in a direction at right angles to the lines of force and line of flow. This was obtained in the following way:—A glass tube about 200 centims. long. and 2 centims. wide, had platinum plates 15 mlliims. wide placed along its inside and at opposite sides with their lengths parallel to the axis of the tube. Platinum wires welded to these plates were sealed through the glass. The plates were curved to lie closely against the sides of the tube. This tube was placed vertically between the poles of a large electro-magnet, the line joining the platinum plates being at right angles to the line of the poles.

To the upper end of the tube was attached another, leading to a reservoir of dilute sulphuric acid placed high above the floor. To the lower end, a tube leading to a receptacle on the floor. The platinum plates were then connected with a distant galvanometer. When the magnet was not excited, no flowing of the liquid had any effect on the galvanometer; but when it was excited, at the moment the flow began the galvanometer showed a deflection of 10° to 15°. Since the only part of the galvanometer circuit in motion is the liquid, this deflection was due to the magneto-electric current generated in it by its movement. It was noticed that the plates were *polarised* by the currents so created. As a consequence of this, the deflection of the needle soon fell to zero; and on the liquid flow being stopped, a polarisation current in the opposite direction was obtained. This proved that in experiments on induction in liquids in order to obtain any constant current, non-polarisable electrodes must be used.

2. *Production of induced current in a mass of liquid rotating over a magnetic pole.*—In this case radial currents should be produced. They were obtained as follows. Flat porous cells were placed round the circumference of a large basin, and in the centre a cylindrical one. These were filled with a solution of cupric sulphate, and contained copper plates. The basin was filled with dilute sulphuric acid. The centre copper plate was connected with one pole of the galvanometer, and the circumferential ones with the other. The whole was placed over the pole of the electro-magnet. On exciting the magnet and rotating the dilute acid, a constant current was obtained, flowing from centre to circumference or the reverse, according to the direction of rotation. With platinum electrodes the effect cannot be obtained; but with non-polarisable electrodes it is easily produced. Mercury was likewise tried with still better results.

3. *Production of induced current in a liquid at rest in a variable magnetic field.*—If a flexible tube filled with conducting liquid is wound round an electro-magnet, and into the ends electrodes placed so as to include a galvanometer in the circuit, then induced currents are obtained whenever the strength of the magnet varies. This is the case examined by Faraday. His experiment was repeated by MM. Logeman and Van Brede (Phil. Mag. [IV.] vol. viii. p. 465), who noticed that the electrodes were left polarised after the induced current had passed. These experiments were repeated with more powerful apparatus, using a soft iron wire core within the inducing helix instead of solid iron, and employing a condenser in the primary circuit. Very strong induced currents were obtained, and correspondingly great polarisation of the electrodes placed in the ends of the coil of acid. It was hoped that the currents might produce visible inductive electrolysis, but even this improved arrangement did not yield that result. Other saline solutions were tried with similar results.

Lastly, the phenomenon observed by Arago, of the retardation in the vibrations of a magnetic needle oscillated near the surface of liquids was examined. Evidence is brought forward to show that this is not, as in the case of solid plates, due to induced currents created in the liquid, (1) because the retardation is, *ceteris paribus*, *not* proportional to the conductivity of the liquid but dependent on its volatility; (2) because it takes place equally when a light brass needle, oscillated by torsion, is substituted for the magnet, provided the needle is light and the period of oscillation not very small. Thus a magnetic needle which required 4 min. 20 sec. to suffer a decrement of 25° in the semi-arc of vibration when in air, required over dilute sulphurie acid 3 min. 30 sec., over ether 2 min. 25 sec. A brass needle of the same dimensions exhibited similar eeffcts.

In conclusion, the magneto-electric induction taking place in moving masses of water on the earth's surface under the influence of terrestrial magnetism is briefly discussed.

Before the introduction of the absolute system of electro-magnetic measure, there was no means of estimating the electro-motive force so brought into play by the flow of a river or ocean stream, and the magnitude of the effect was perhaps over-estimated.

A table is given, showing the electro-motive force in volts produced in two or three cases.

	Difference of potential between two sides in volts.
Gulf-stream at lat. 30° N., long. 60° W.	8·6
Equatorial current, lat. 10° N., long. 40° W.	10·0
Dover and Calais tidal current	3·0
Thames at Waterloo Bridge	·016

This electro-motive force without doubt generates a current transverse to the direction of the flow; but since the surrounding still water or the river bed, or channel, is not a non-conductor, any attempt practically to detect it by plates placed on either side of the stream is not likely to succeed, since the current through the galvanometer is only a derived portion of the current in the stream.

A comparison of a chart of ocean-currents with one of the isogonic lines does not seem to show any distortion of the lines of equal variation where they cut across. If, now, electric currents of any great magnitude were generated in ocean-currents, such would undoubtedly be the case. Though Faraday's failure to detect any magneto-electric current in the Thames may have been partly due to his employment of polarisable electrodes, still there is evidence enough to show that these currents, though certainly existing and capable of being produced on a laboratory scale, cannot be considered as contributing in any sensible degree towards affecting the form and distribution of the isogonic lines. Those who have looked to this as a possible partial cause of the irregularity observed, have been led no doubt by the dimensions of the streams to exaggerate the magneto-electric induction caused by their flow.

THE SOCIETY OF TELEGRAPH ENGINEERS.

At the Ordinary General Meeting of the Society, held oe Wednesday, the 28th February, the chair was taken by Professor Foster, one of the Vice-Presidents. The Chairman having announced, that owing to the importance of the Paper for that evening and the arrangements which had been made in connection with it, the adjourned discussion on Mr. Preece's Paper on "Shunts" would be deferred until some befitting opportunity, of which timely notice would be given to the members. A Paper on "Fire-Telegraphs," by Mr. R. von Fischer Treuenfeld was then read, a *resumé* of which is appended,

Fire-Telegraphs.

That a properly organised system of Fire-Telegraphy forms a most important adjunct to the operations of a fire brigade, can, we think, hardly be doubted by any who has given the subject a moment's consideration.

It has, on careful examination of practical and scientific facts, been deemed correct to state, that the difficulty in extinguishing a fire under ordinary circumstances varies at least with the square of the time that elapses between the outbreak of a fire and the arrival of the brigade at the spot. Further, there can be no question, that if the necessary steps were taken to quell a fire immediately it broke out, it would be well-nigh a matter of impossibility for the fire to assume serious proportions.

Bearing these two facts in mind, it requires but little perception to recognise the paramount importance of a speedy transmission of an alarm, upon the outbreak of a fire, to the nearest fire-station, whence immediate orders can be issued for its suppression. It is for this purpose that electricity can be and has been applied, and, theoretically speaking, a perfectly efficient system of Fire-Telegraphy would in this direction leave nothing to be desired.

In England Fire-Telegraphs are still a thing of the future, though in America and on the continent they have long been, and still continue to be, employed with success. The city of Boston, in America, was the first to employ them in that country in 1851; and from that time their use has spread over the whole of that continent, until Fire-Telegraphs now keep guard over no less than seventy-nine cities, while in Germany no town of large population is unattended by them.

Let us examine how London stands with respect to cities protected by a system of Fire-Telegraphy in the matter of slight and serious fires. London is served by a brigade with a well-earned reputation for bravery and ability, and the water-supply is most efficient, the total number of hydrants erected being at present 4,211. Yet here are the statistics:—

Year.	Small Fires.	Serious Fires.	Percentage of Great Fires.	
1866	1,012	323	24·2	
1873	1,382	166	10·7	10·1
1874	1,419	154	9·8	
1875	1,366	153	10·	

The above table, although showing that, notwithstanding the increase in population, the fire-brigade has succeeded in lessening by more than one-half, the proportion of serious to small fires, yet betrays the fact that 10 per cent. of our fires are serious ones. This number is far too high. Take, for instance, the statistics of the town of Berlin, which is not so efficiently served either with engines or water as London, but in which a system of Automatic Fire-Telegraphy is in operation:

Year.	Small Fires.	Serious Fires.	Percentage of Serious Fires.	
1873	873	28	3·11	2·82
1874	906	26	2·79	
1875	983	26	2·57	

In these tables by the term "Serious Fire" is meant one for whose extinction more than two engines or reels were required. Hence we find that in Berlin, which is not specially picked out as a favourable specimen, and only one of the many instances indicated by the copious statistics met with in the paper, the proportion of serious fires is less than one-third of that for London.

Having, it is hoped, thus shown the necessity for a system of Fire-Telegraphy, we may turn our attention to another portion of our subject—namely, the most efficient system of Fire-Telegraphy.

In order to guide us in our examination of the different systems, we may glance at those actually in operation.

In Hamburg there are two central stations, one in the hands of the Fire Department, the other in the hands of the police. Both are in immediate connection with each other and with seven district lines which run radially through the town and suburbs. On these lines are placed automatic annunciators and speaking stations, and from any of these an alarm can be immediately sent to the central fire-station, whence the necessary orders are issued.

The Automatic Fire-Annunciator as in use on the Continent is a simple mechanical contrivance, whereby a certain signal can, by the pulling of a handle be transmitted to the central station. It consists of a box closed by a glass front. It is opened by a key entrusted to the police or other officials, but in practice the glass front has to be broken in order to allow the signal to be sent. Inside is fixed a smaller cast iron box perforated below by holes through which pass three cords, two of which sustain a weight. To a third is attached a handle, which, when pulled, allows the weight to descend a certain distance. In descending, the cords which sustain the weight move round a simple system of pulleys in the interior of the cast iron box, thereby causing a cam or toothed wheel to revolve on the outside of the case. The teeth of this wheel are so cut, that when the cam revolves, it makes contact at certain points on its periphery with a spring, in connection with the line. The duration of these contacts determine the signal registered on the self-starting Morse-inker at the central station, and each annunciator has a different cam, in order that the signals received may be identified with that given by a certain annunciator. The cam is made to revolve twelve times when the handle is pulled, and when at rest it permanently touches the above-mentioned spring, so that a current is continually flowing through the line, ceasing only when a signal is sent. Each annunciator contains in addition, a galvanoscope, a lightning protector, and a Morse key, whereby messages can be sent.

Fifty cells of the Meidenger type are in use on each line.

There are in Hamburgh fifty-three Automatic Annunciators and fifty speaking stations, and the total length of the lines is 339,400 feet, consisting of overhead and underground wire.

Except when messages are being sent none of the Morse instruments are in circuit, except at the central station. Bells, however, remain in their place. Immediately a signal is received at the central station, the official in charge sends by means of a magneto-electric inductor, a Fire-alarm signal to all the speaking stations on the circuit, or, if need be, by means of a special commutator to all the stations on the seven circuits simultaneously. The operator at each of the various stations hearing his alarm-bell ring, takes up his position at the table upon which his instrument is fixed, and presses his foot upon a lever beneath, thereby cutting the bells out of circuit, and inserting his instrument. He is then ready to receive such directions as the central station shall think proper to issue. As soon as he leaves the table the lever, disengaged, returns to its former position, thus re-establishing the bells in the circuit.

The entire system has been erected at a cost of only £8,028, and is maintained at a yearly expenditure of £80.

The Fire-Telegraphs in Amsterdam differ only in the system of circuits. The whole town is divided into three circles, upon which are fixed speaking stations,

upon which are formed smaller circles, on which annunciators are alone placed.

A third system has as its type the town of Frankfort-on-Maine. It consists of an arrangement of radial lines projecting from a central fire-station. From the speaking stations placed on these lines proceed smaller lines, or branches from the main system.

In the operation of these systems certain rules have to be attended to. The most important of these is:—

> Urgent messages, such as fire-alarms, may alone break in upon correspondence; when they do so the correspondents must give way at once. There can be no mistaking the annunciator signal both from its regularity and from the number of times it is repeated. So that when a message is broken in upon by the annunciator signal, the stations cease speaking and the annunciator alarm is received.

The *modus operandi* in some towns in America differs slightly from the above. The difference consists in the reception of an alarm. When an annunciator calls, an automatic arrangement at the central station distributes the signal over the whole department simultaneously. Hence any possible delay consequent upon the transmission of orders is avoided. The only disadvantage being that there is not the same facility for speaking and directing during the existence of a fire as is the case with the system in use on the Continent.

As an example of the benefits reaped from such systems, the following must suffice, since space presses:—

The Chief of the Montreal Fire Department, A. Bertram, in his report of 1866, says:—"As the simplest illustration of the great value of the Fire-Alarm Telegraph we have the fires and loss for a fair average before and since its introduction—

Before, 85 fires.....140,088 dols. loss.
Since, 99 „ ..... 35,428 „

In conclusion, the principles of construction claimed by a perfect Fire-Telegraph system are briefly these.

(*a*) Entire control and management of the line by the Fire-brigade Department.

(*b*) Underground cables.

(*c*) A system of circles or radii, with a suitable number of speaking stations and Automatic Fire-Annunciators, all terminating in one or more central stations from which commands are issued to the entire system.

An appendix to the paper was then read, giving the opinions of many competent authorities in England and elsewhere on the subject, and from which the author drew some important conclusions. It was, he showed, worthy of remark that all to whom he had written on the subject, including many eminent chiefs of the brigades in different towns, expressed their convictions of the important benefits of a system of Fire-Telegraphy. As an example, we may quote the opinion of a chief of the brigade in one of the largest towns in Great Britain, who says:—"There can be no two opinions as to the advantage of Fire-Telegraphy. I have no hesitation in saying that it has been the means of saving many lives at fires, and preventing a large amount of property from being destroyed. At the same time we have in our experience far too many instances in which it has been found out of order when required. Such being the case, it has its disadvantages as well as advantages; many a precious moment has been lost through defective instruments."

In the case in question, the Telegraph system at the command of this officer is in the hands of the three departments—the Fire Department, the Police, and the Post-Office—and the instruments are alphabetical dials. We need hardly point out under what difficulties the system therefore works, and how great must be the liability to disorder amongst instruments of such a nature.

We now come to a question of considerable importance to the Telegraph engineer, and one which has lately been brought up, to some extent, in the pages of the TELEGRAPHIC JOURNAL, namely, whether signals sent by Automatic Fire Annunciators are liable to become confused through the starting of the mechanisms at, or nearly at, the same moment in different quarters of a town.

In answering this question, we have to deal with theoretical considerations and practical facts. There can be no doubt that the latter are by far the most weighty arguments in dealing with any question where the circumstances under which they were matured and collected remain the same for the case under consideration. There can at the same time be little doubt that, no matter what the size of a town may be, in a system or series of systems similar to those described in the Paper, the conditions remain constant, and the changing factor is number. Consequently, if this hypothesis be correct, we may rationally suppose that the practical facts met with on the Continent and in the United States will hold good in any town, of whatever size, in Great Britain. The experience of a quarter of a century, compiled in both these countries, leads but to one conclusion—that no danger need be apprehended in this direction. Such cases may occur when the system comprises domestic requirements of a universal nature: but in the case of Fire-Telegraphy simply, the messages are obviously of a comparatively too unfrequent character to cause any uneasiness. It may be urged that, in a city of such a size as London, the tendency of messages to run together would be very greatly increased. This idea will, we think, be altogether dispelled on a little consideration; for, take the last system described in the Paper—viz., the radial with branches—the number of these systems depends simply on the size of the town in which they are employed. Or, again, the town may be subdivided into different systems, each possessing a head office of its own. In the towns in which the systems described are in operation no case has occurred within the memories of the chiefs of the brigades of any such confusion, although cases *had* occurred in which an alarm had been followed by another so closely as to have run into each other to a slight extent; but owing to the fact that the Annunciator signal is repeated from six to twelve times, only the end of one series and the commencement of the other was confused, but which still allowed both signals to be read.

Another fact, illustrating the benefits to be derived from Fire-Telegraphy, is shown by the following table, taken from last year's report of the Bremen Fire Brigade, and in which the fires are grouped according to the time occupied in extinguishing them, the time commencing from the first telegraphic call to the return of the brigade.

Year.	Total number of Fires.	Subdued at arrival of the brigade	In ¼ hr.	In ½ hr.	In ¾ hr	In 1 hr	In 1½ hrs.	In 2½ hrs.	In 3 hrs.	In 4 hrs.	In 5 hrs.
1876	439	338	15	31	21	14	11	4	2	1	2

This table indicates that if the fire be not "brought under" in the first quarter of an hour, some difficulty will be experienced in extinguishing it; for in the table the number of fires subdued then increases by as much again to thirty-one, whence it gradually declines.

The apparatus described in the paper was exhibited and worked. The Autokinetic and Exchange Telegraph Company's systems were also shown in action.

The discussion was taken up by Messrs. Montifiore,

Higgins, and Moir, and was closed by the Author, when a hearty vote of thanks was accorded, on the motion of the chairman, to Mr. Treuenfeld for his excellent Paper. The discussion was deferred until the 14th inst., and the meeting then adjourned.

PHYSICAL SOCIETY—3RD MARCH, 1877.

Prof. G. C. FOSTER, President, in the chair.

THE following were elected Members of the Society:—Mr. J. A. Fleming, Mr. P. le Neve Foster, and Mr. S. Hall.

Prof. FOSTER showed experimentally the polarisation of heat rays, employing two large Nicol's prisms of 2⅜-inch aperture, and a thermopile, surrounded by a double jacket and connected with a Thomson Galvanometer, as arranged by Mr. Latimer Clark, for showing very slight indications to an audience. When the principal sections of the prisms were at 90 deg. to each other, only a slight movement—doubtless due to an initial heating of one side of the pile—was observed, and the amount of the deflection was found to increase steadily up to about sixty divisions on the scale as the above angle was diminished. Prof. Foster exhibited the results of experiments made to determine the intensity of a source of heat by this means, and they were very concordant.

Mr. LATIMER CLARK then explained the arrangement of the galvanometer used. The image of an arrow-head, or other form of index, projected by means of a lime-light at the further end of the room, traverses a telescopic object-glass about two feet distant, and falls on a square silvered plate of glass suspended from the needle of a Thomson Galvanometer, which is rendered steady in the ordinary way by a platinum spade in water. The reflected image then traverses the whole length of the room, and falls on a large scale placed in front of the audience; and, by such an arrangement, the instrument may be at any distance from the scale, and yet the image will not be unduly magnified. A method is employed for bringing the needle rapidly to rest. A few thermo-electric couples are placed above the lamp-chimney, thus being kept constantly hot, and the terminals are united by a wire, which is coiled several times round the galvanometer; a key is introduced, and depressed at the moment when this subsidiary current will tend to neutralise the motion of the needle.

Mr. WILSON then explained some difficulties he had met with in constructing a Holtz Electrical Machine, especially with reference to the windows and armatures, and exhibited two machines which he recently made, from one of which a spark five or six inches in length can be obtained. He explained how he was led to construct an instrument in which there were no windows, the armatures being placed on the face of the fixed plate next to the moving plate, but the result was not satisfactory. He then made the larger machine provided with six fixed and six moving plates, and the windows were replaced by holes ½-inch in diameter, traversed by short pieces of tape glued to the paper armatures. The initial charging of the armatures is effected by means of a disc of ebonite fixed to the main axis of the machine, which is lightly held by the fingers and caused to rotate, and electricity is thus generated, and points projecting towards it and communicating with points in the neighbourhood of the armatures, cause them to become charged; after this, electricity is generated with great rapidity.

On Saturday, March 17th, at 3 p.m., the following Communication will be made:—"On some Points which have a Bearing on the Theory of the Photographic Image," by Captain Abney, F.R.S.; "On a Modification of Mance's Method of Measuring the Resistance of Batteries," &c., by O. J. Lodge, B.Sc.; "Certain Experiments with a Large Induction Coil," by W. Spottiswoode, F.R.S.

Electrical Science in Foreign Journals.

COMPTES RENDUS OF PARIS ACADEMY. No. 7: 12TH FEBRUARY.

Researches on Calorific Spectra. By M. DESAINS.

IN the spectrum from the electric lamp, one finds heat as far as the blue. In recent experiments by the author, the heat in the luminous portion appeared to be about a sixth of the entire heat. This is only half of what one finds in the solar spectrum. If, however, the light of an electric lamp be passed through a layer of water of 3 to 4 centimetres, the calorific intensity of the dark part of the spectrum is considerably reduced, while the luminous heat is hardly affected; and the latter then becomes about a third of the total heat, as in the solar spectrum. The spectrum thus got is not absolutely identical with the solar spectrum: it has less extent, especially towards the violet end; but the curves of intensities in the two show but slight differences in the region between the middle of the green, and the part of the dark spectrum symmetrical with the blue. It was found impossible to bring the spectrum from incandescent platinum to a like correspondence with the solar spectrum, by interposition of layers of water. In this spectrum, the luminous heat is but an insignificant fraction of the whole.

AMERICAN JOURNAL OF SCIENCE AND ARTS. JANUARY, 1877.

On the Production of Transparent Metallic Films by the Electric Discharge in Vacuum Tubes. By Prof. WRIGHT, of Yale College.

WITH a view to remove mercury vapour from some vacuum tubes, the author put in each tube some loose pellets of clean gold foil. Or he wrapped a small piece of foil round the end of the electrode, or attached to it a short gold wire. The gold is volatilised and deposited on the walls of the tube in a very thin layer, exposing a much larger surface to the mercury vapour. A loose roll of foil being place in the middle of a tube, gold was deposited, when discharge took place, and by shaking the foil along, a considerable area could soon be covered. The volatilisation occurred only at the end made a negative pole, except with very powerful discharges. The matter seemed interesting, as furnishing a new method of producing transparent metallic films, and various other metals were tried. The best method was found to be this: clean tubes of white glass, about 15ctm. long, and 4 to 6mm. diameter, were provided in the middle with a small branch tube for attachment to the pump. In the end were placed the electrodes formed of the metals to be examined; they were generally thin wires ½ to ¼mm. in thickness. About 1ctm. of this was enclosed in a thin glass tube about 3ctm. long, drawn out of the same piece as the main tube, and made so fine at the end as just to receive the wire. A platinum wire was placed in the other end, so as to touch the first wire, and sealed in. This was then carefully sealed into the end of the main tube, the electrode being in its axis, and the platinum wire

projecting. The tube was then exhausted, and the discharge passed through it. After the film was sufficiently developed, the small branch was closed with a gas flame, the tube drawn off, and sealed. For metals readily oxidised the tube was filled several times with hydrogen and exhausted. Regularity of the electrical action was important for the perfection of the film; and with the Holtz machine no effect was got without condensers. Prof. Wright proceeds to describe the changes of colour and appearance in formation of films of gold, silver, copper, bismuth, platinum, palladium, lead, zinc, cadmium, aluminium, magnesium, tin, iron, nickel, cobalt, tellurium, &c. Bismuth was volatilised most readily of all, gold and silver with but slightly less facility. Platinum, palladium, lead, tin, zinc, and cadmium yield less readily; while copper, iron, nickel, and cobalt require a rather intense discharge. Aluminium was volatilised with considerable difficulty, requiring five or six cells and a powerful coil; and magnesium yielded even less readily. Iron gave a very beautiful and perfect film, of brilliant lustre and high transparency. The light transmitted by it is very nearly of a pure neutral tint, but with a faint tinge of brownish. For nickel, cobalt, and tellurium a special method was needed. The films are generally very uniform and coherent, and even under the microscope appear perfectly continuous. They polarise the light transmitted by them powerfully, and the degree of polarisation appears to increase with the incident angle, implying a very high refractive index.

ANNALES TÉLÉGRAPHIQUES.
NOVEMBER-DECEMBER, 1876.

General Battery Commutator. By M. MERCADIER. THE object is to group in any manner the elements of a given battery. M. Mercadier first describes the Swiss commutator, and points out its faults, which he remedies by another arrangement. In this latter there are three long plates (A, B, C,) of copper, fixed in a thick plate of ebonite. One, C, is continuous; A and B are divided into a number of rectangular pieces insulated from each other but capable of being connected together, and with C, by copper plugs. The pieces of A are connected with the positive poles of the battery elements, those of B with the negative. The advantages are, easy management, excellent contacts always visible and verifiable, complete utilisation of all parts of the apparatus (so that with 20 elements, *e.g.*, one may obtain all the groupings of these possible), easy construction without complication, and a very small surface relatively to the number of elements.

On the Brooks Insulators compared with the Double Cup Porcelain Insulators. By M. GAUGAIN. THE Brooks insulators, as well as the porcelain, lose very rapidly the greater part of their resistance when exposed in the air, but after a short time (three or four months) the alteration of the surfaces stops in both cases, or makes little further progress. If they could be cleaned every week or every fortnight, the insulation would doubtless be much improved; but this being impracticable, the experiments show, that without grave inconvenience, all cleaning may be dispensed with, since the insulation is hardly more perfect with insulators which have been in position only three or four months than with others which have been exposed in the air two years. As to the effects of rain, the deflections obtained with the porcelain insulators increase or decrease with its intensity; not so the deflections with the Brooks insulators; these continued to increase after the rain had entirely ceased, not attaining their maximum value till half an hour after. This is thought to be probably due to the temperature of the insulators rising after the rain has ceased (especially if the sun comes out) and the conductivity of the paraffin increasing with this rise.

Trial of Direct Communication between London and Malta, with Brown and Allan's Relay. By M. GRAMMACCINI. THIS experiment was made at Marseilles. The relay named is a Siemens' relay improved by addition of a contact-rod, giving much more rapid action. One translation, worked by hand, was arranged at Bona, another at Marseilles; there were besides, the ordinary translations of Paris and Beachey Head. The average of transmission did not exceed nine or ten words per minute; and the transmission was generally defective, the *employés* not being used to this kind of work; hence loss of time in rectification. Thus direct translation through a long land-line connected with a long submarine cable is shown to be possible; but the author doubts if it has real practical interest. There would be economy in *employés* and a single translation; but, on the other hand, the work is first less rapid, and the translation must be suspended from time to time to permit the sending of local telegrams. Supposing no local traffic, the transmission would still be disadvantageous, for the cable is a capital which should produce so many telegrams hourly. It is thus important to have the maximum production, and this is at present obtained by use of the Thomson mirror apparatus or the recorder. With the Morse, the cable without translation can hardly give more than 20 telegrams an hour, or 480 in twenty-four hours; with translation, it will give only 15 or 380; but the land-line is generally interrupted four or five hours in the twenty-four, which reduces the work produced to about 300 telegrams, while the land-line alone could produce an average of 25 telegrams hourly, or 600 in twenty-four hours, that is, even failing the lost hours for working the cable.

ANSWERS TO CORRESPONDENTS.

STANLEY CLARKE.—From time to time it is intended that papers for Students shall appear in the JOURNAL. The work for which you ask can probably be had from J. Rothschild, 13, Rue des Saints Pères, Paris. The price is about 3.50 francs.

RUDOLPH WHO, Rheydt.—There is no work, so far as we are aware, giving the information for which you ask. We learn on inquiry that Messrs. Letts and Son, of King William-street, London, are to publish annually, commencing with next year, a Diary, giving the particulars which you want.